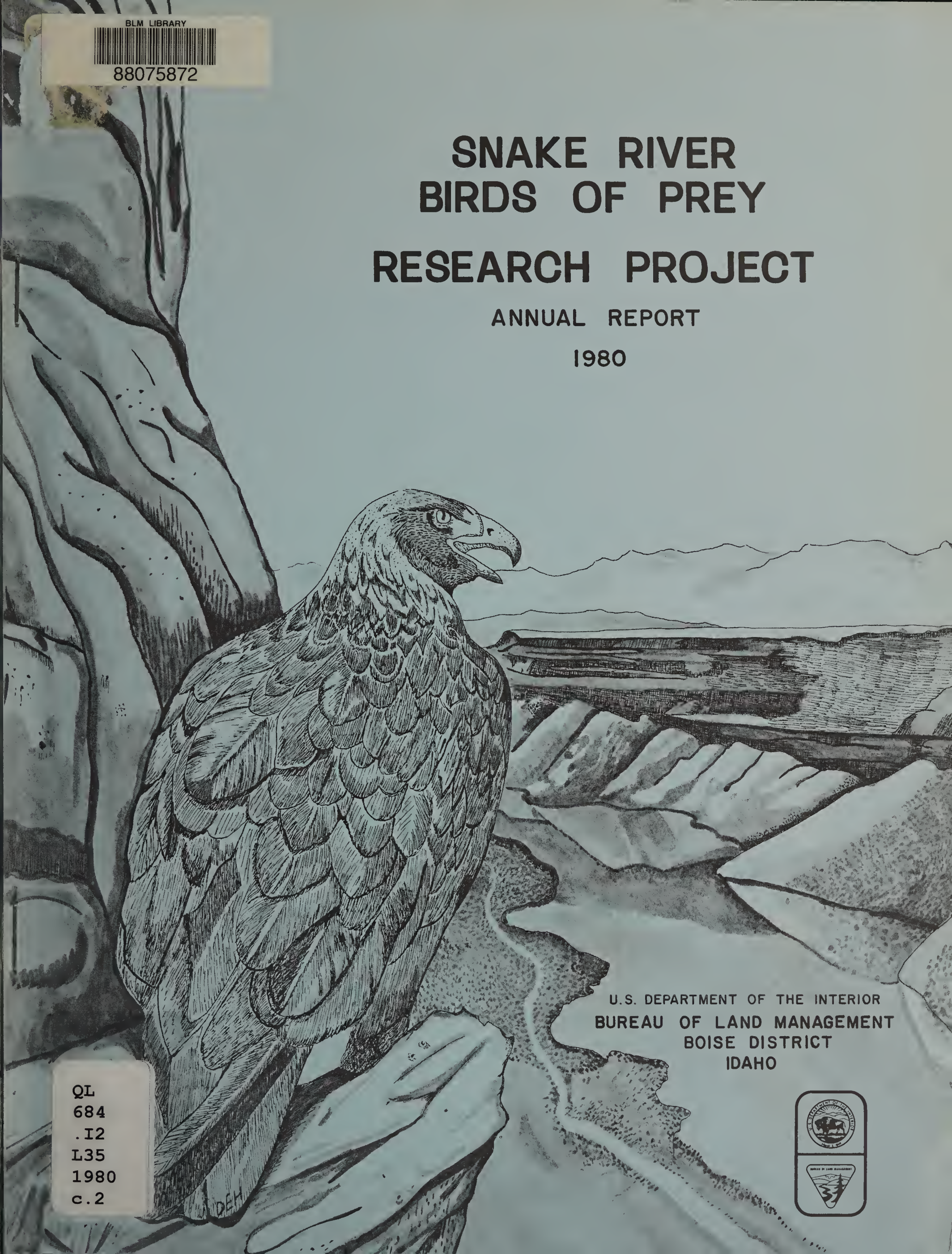
SNAKE RIVER BIRDS OF PREY RESEARCH PROJECT

ANNUAL REPORT

1980



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
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NOT FOR PUBLICATION

The data presented herein are preliminary and may be inconclusive. Permission to publish or cite any of these materials is therefore withheld pending specific authorization of the Boise District, BLM, and the specific Principal Investigator.

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ACKNOWLEDGEMENTS

The Bureau of Land Management wishes to thank those agencies and individuals who assisted with the project. Appreciation is extended to the Idaho Fish and Game Department and the U.S. Fish and Wildlife Service for special permits and assistance. Thanks is extended to the Idaho Cooperative Wildlife Research Unit for furnishing the original background data and nest site locations and to those other individuals who volunteered their services.

Special appreciation is extended to Mr. E. T. Evans for providing the area for the Melba field camp and other assistance. Teresa Thomason deserves special thanks for typing the manuscripts.

COOPERATING AGENCIES

Idaho Fish and Game Department
U.S. Fish and Wildlife Service

PREFACE

Like 1979, 1980 was a Transition Phase year. Emphasis was placed on automating and debugging the backlog of Phase I data for publishing the research results. Raptor and prey monitoring continued, and studies were initiated on those species which received little attention in Phase I. Data analysis continued on the reptile ecology study, and a dissertation was completed on the Golden Eagle bioenergetics study.

Raptor and prey field studies were similar to 1979. Raptor nesting and food habits studies and the mid winter golden eagle survey were conducted at the same intensity. In addition, a cooperative study with the University of Montana was initiated on Long-eared Owls. Work continued on monitoring prey densities in the various vegetation and cover types. The University of Idaho contractor listed and mapped fires that occurred in the Birds of Prey Area from 1950 to 1980 and completed a report on the history of grazing in the area.

No decision was made on the Phase II proposal. However, some preliminary work on Phase II began. Three of five planned livestock exclosures for Phase II were constructed in the Spring-Fall range of the Birds of Prey Area. Sampling of these exclosures is to begin during the 1981 field season.

Other than field work and data analysis, much of the in house staff's time was spent analyzing several proposed boundary modifications for the Snake River Birds of Prey National Conservation Area. The staff also prepared documents for the lawsuit filed on the Birds of Prey EIS by Sagebrush Rebellion Inc. in April. The Secretary of the Interior introduced legislation in the House and Senate in May 1980 to establish the Birds of Prey National Conservation Area by amending Title VI of the Federal Land Policy and Management Act (FLPMA). No action was taken on the bills. Therefore, in November 1980 the Secretary of the Interior withdrew the area identified in the proposed legislation under Section 304 of FLPMA. The action prevents disposal of public land for private irrigated aggricultural development under the Desert Land Entry and Carey Acts. It also prohibits hard rock mining in the immediate vicinity of nest sites. Congress is allowed 90 days to reverse this 20-year withdrawal by a concurrent resolution.

This report presents the data collected and the results of the component studies of the Birds of Prey Research Project during the 1980 calendar year.

TABLE OF CONTENTS

TITLE: Reproductive performance, food habits, and population dynamics of raptors in the Snake River Birds of Prey Area (Study I).

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OBJECTIVES:

1. To determine occupancy and reproductive performance of golden eagles, prairie falcons, red-tailed hawks, common ravens, and ferruginous hawks at preselected traditional sites.

2. To determine food habits of golden eagles, prairie falcons, red-tailed hawks, and common ravens.

3. To determine wintering golden eagle densities in and near the study area.

ANNUAL SUMMARY

Data collection continued in 1980, the third transition year. Research focused on golden eagles (Aquila chrysaetos), red-tailed hawks (Buteo jamaicensis), prairie falcons (Falco mexicanus), ferruginous hawks (Buteo regalis), and common ravens (Corvus corax) as in previous years. Golden eagle reproduction increased slightly, despite a drop in percent breeding. Prairie falcon reproduction climbed to the highest level observed since 1977; successful pairs fledged an average of 4.09 young, the highest rate ever observed. Red-tailed hawk reproduction, however, declined substantially, apparently because of a decline in the percent of breeding attempts that were successful.

Eagle and red-tailed hawk diets showed no major changes from preceding years. Black-tailed jackrabbits (Lepus californicus) continued to be the principal prey of eagles, and lagomorphs and Townsend ground squirrels (Spermophilus townsendii) were still the red-tailed hawks' favored prey. The percent frequency of ground squirrels in the prairie falcon diet increased from 43% in 1979 to 75% in 1980, the highest ground squirrel proportion ever observed. Ferruginous hawks fed almost exclusively on

mammals, and ravens fed on a wide variety of prey species. Numbers of golden eagles counted on transects in January decreased, but the proportion of immatures increased. Three hundred and eighty-three individual raptors were banded.

INTRODUCTION

Field work for Phase I research in the Snake River Birds of Prey Study Area (BPSA) was completed in 1978. In 1979 and 1980, interim research was conducted on those raptor species intensively observed from 1973 to 1978. The intention was to continue monitoring the reproductive performance and nesting population density of selected birds of prey species until decisions were made on National Conservation Area status and future research needs for the BPSA. This report is a brief presentation of the 1980 results. Data from other years are included for comparison purposes.

Several portions of the Phase I research were modified or eliminated during the interim phase of research. No effort was made to determine total nesting density in the BPSA or Comparison Area. Nest site occupancy was studied within the 1977 Study Area only at sites randomly selected for intensive research. To reduce investigator induced mortality, we did not intentionally collect data on clutch size and hatching success. Fall aerial transect counts of golden eagles were eliminated because results were not necessary for the current research effort.

Data were collected on several other facets of raptor ecology but are not presented in this report. Management techniques, migration, effects of researcher disturbance, raptor behavior and mortality causes are still being studied. Results will be presented when work is complete.

METHODS

Study Area

Research on raptors was conducted within the 1977 BPSA (Fig. 1). In addition, the Comparison Area was searched for golden eagles. A complete description of the BPSA and Comparison Area is given in USDI (1979). Observations concentrated on golden eagles, prairie falcons, red-tailed hawks, common ravens, and ferruginous hawks.

Prior to the breeding season, 207 territories that had been occupied by raptors in previous years were selected for intensive study. All 36 golden eagle and 29 ferruginous hawk territories in the BPSA were "preselected"; 77 prairie falcon, 30 red-tailed hawk sites, and 35 raven sites were selected using stratified random sampling with proportional allocation according to densities in each 10 km stretch of the river.

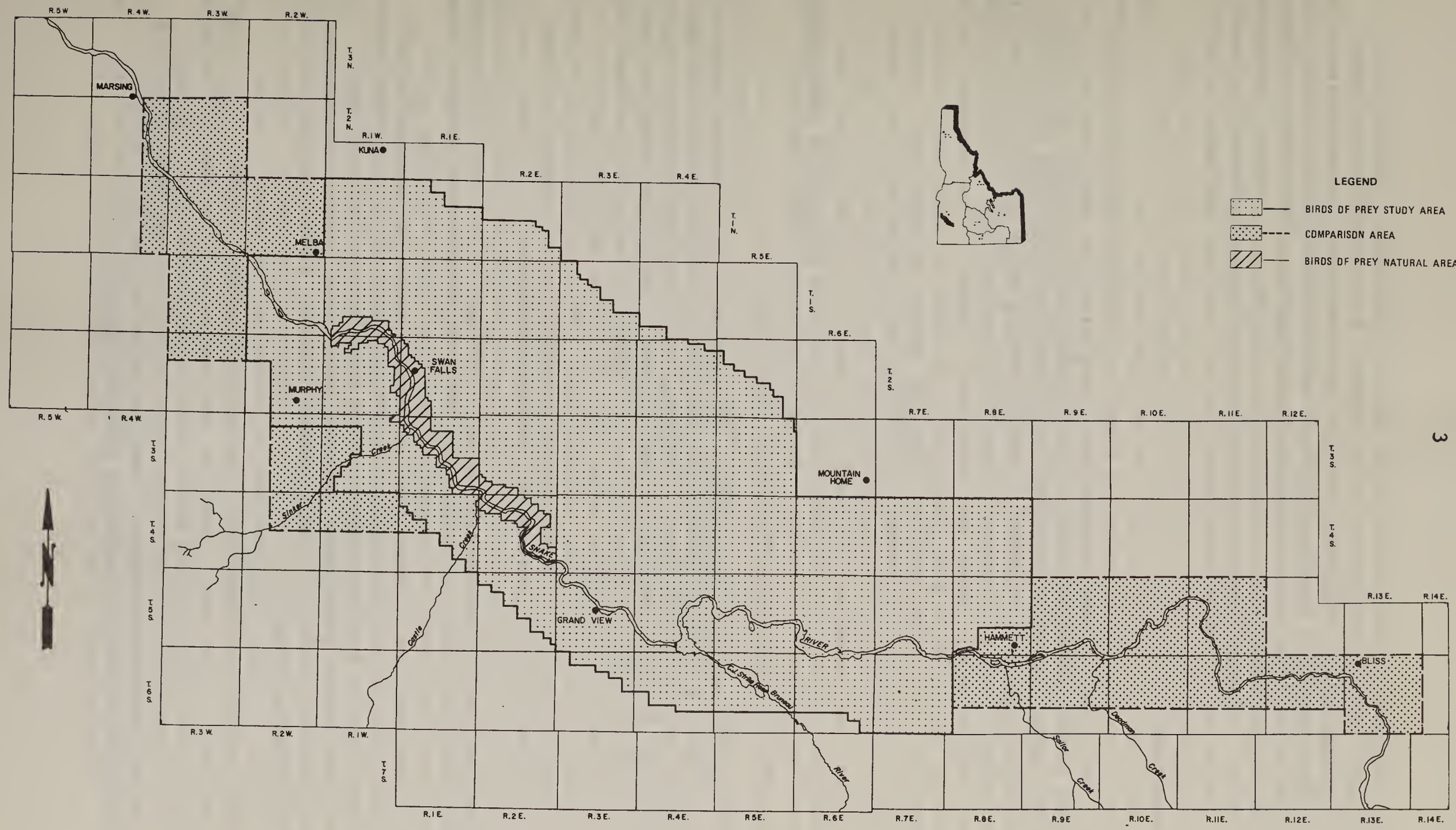

Fig. 1. LOCATION OF THE BIRDS OF PREY STUDY AREA (BPSA) AND COMPARISON AREA

We attempted to ascertain nesting success and number fledged at all preselected sites. Behavior of adult raptors, inaccessibility of nest sites, and logistical problems prevented observation of all variables at all sites. When possible, breeding attempts were confirmed by observing incubating or brooding adults without disturbing them. This year, as in 1979, we did not attempt to collect data on clutch size or mean brood size at hatching. However, because prairie falcons frequently nested in cavities, adults could not be seen incubating or brooding, and most falcon breeding attempts had to be confirmed by climbing into the scrape and observing eggs.

Pairs that occupied preselected sites but showed no evidence of egg laying after repeated observations were categorized as "non-breeding". A "breeding attempt" was confirmed if an occupied site contained an incubating adult, eggs, young, or any field sign that indicated eggs were laid, such as fresh eggshell fragments in fresh nesting material. A "successful nesting attempt" was a breeding attempt that produced one or more young that reached fledging age. Young were considered fledged if they reached 80% of the average age at which most young leave the nest of their own volition. Fledging ages were established by observing chicks of known age. Active eagle and buteo nests discovered after young had fledged were considered successful if (1) a platform decorated this season was worn flat and contained fresh prey remains; (2) fresh fecal matter covered the back and extended over the edge of the nest; and (3) no dead young birds were found within a 50-m radius of the nest. Renesting attempts were considered separate new attempts in calculating productivity.

Preliminary analysis conducted in 1980 showed that the overall productivity of raptors was not affected by observation blinds, radio-tracking activities, or time lapse camera. However, there was some evidence to indicate that disease treatment, shade devices, insecticide spraying, and fostering all enhanced survival rates of chicks. Consequently we excluded from our productivity analysis sites with the latter manipulations but included sites with the former manipulations. We also excluded sites where egg or nestling mortalities were directly caused by investigators. Past years' data were recalculated using these guidelines.

Prey remains and regurgitated pellets were systematically collected from 9 golden eagle, 9 prairie falcon, and 9 red-tailed hawk nests every 4 days. The eagle and hawk nests were selected and stratified according to the amount of agriculture within a 5 km radius of the nests; prairie falcon nests were selected and stratified according to relative ground squirrel densities in their foraging ranges. Food remains were gathered non-systematically from ferruginous hawk and raven nests whenever convenient; 15 collections were made at 9 ferruginous hawk nests, and 45 collections were made at 25 raven nests.

Fresh remains were identified, marked by removing the head, feet, and tail, and left in the nest. Inedible remains and pellets were collected and analyzed in the laboratory by Randy Olson of the University of Montana. Species, size, and sex of prey items were ascertained by comparison with study skins and taxonomic keys. A weight value was assigned to each species-age-sex class for computing biomass (Appendix B).

Prey numbers in the castings were calculated from a maximum count of body parts (femurs, toe-nails, feet, and/or mandibles). Prey remains identified in regurgitated pellets were compared with the tally of fresh prey individuals and partially eaten prey identified during the previous collection. If it was likely that the remains in the pellet were formed from a prey individual that had already been counted, the duplicate was excluded from totals.

In January 1980, twenty golden eagle aerial transects were flown over the Snake River plain between Meridian and Rupert, Idaho as in previous years (Kochert et al. 1977).

Nestling raptors were ringed with U.S. Fish and Wildlife bands, and golden eagles were fitted with a yellow-blue bicolor marker on the right wing. Most banded chicks were weighed, and their foot pads were measured (Kochert et al. 1977).

RESULTS

Reproductive Performance

The percent of golden eagle pairs that bred dropped from 97% in 1977 to 87% in 1980 (Table 1). This year's breeding rate was still higher than the 1978 level of 80%. Only one clutch of two eggs was counted; this was identical to the average clutch size in 1979. The proportion of breeding attempts that were successful increased from 59% in 1979 to 68% in 1980. Number fledged per successful attempt also increased. Number fledged per pair returned to the 1978 level of 0.97 after having dropped in 1979 to 0.86.

Prairie falcon reproduction improved generally in 1980 (Table 2). Percent breeding increased 94%; number fledged per successful attempt increased to 4.09, the highest yearly average ever observed in this area. Although the percent of attempts successful declined below the 1979 level, number fledged per pair rose to 2.20, the highest rate observed since 1977.

Red-tailed hawk reproduction declined substantially in 1980 (Table 3). Percent breeding dropped slightly from 85% in 1979 to 83% in 1980, clutch size dropped from 2.75 to 2.67, and hatchability dropped from 75% to 44%. The low nestling survival rate of 67%, lowest since 1977, seemed to be associated with losses of complete broods rather than individual young within broods; the percent of attempts successful dropped from 90% to 68%, but the number fledged per successful attempt remained steady at the 1979 level of 2.63. Total number fledged per pair dropped from 2.01 in 1979 to 1.48 in 1980.

Raven reproduction, on the other hand, improved in 1980 (Table 4). Number of young fledged per pair, 3.12, was the highest observed in any year. All measures of raven reproductive success in 1980 showed increases since 1979 except average brood size at hatching which remained at 5.

Table 1. Golden eagle reproductive parameters in the BPSA, 1970-80.* Sample sizes in parentheses.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Percent Breeding	----	100%	----	67%	72%	74%	69%	81%	80%	97%	87%
	----	(30)	----	(33)	(29)	(31)	(32)	(32)	(30)	(30)	(31)
% of Attempts Successful	57%	66%	----	45%	56%	58%	60%	52%	75%	59%	68%
	(7)	(29)	----	(20)	(18)	(19)	(20)	(21)	(16)	(27)	(19)
No. Fledged Per Successful Attempt	1.80	1.95	1.73	1.44	1.50	1.45	1.58	1.56	1.67	1.50	1.64
	(15)	(19)	(11)	(9)	(10)	(11)	(12)	(9)	(9)	(16)	(14)
No. Fledged Per Pair	----	1.29	----	0.43	0.52	0.60	0.63	0.66	0.97	0.86	0.97
Clutch Size	1.87	2.16	----	1.85	1.91	1.92	1.63	1.88	2.33	2.00	2.00
	(8)	(19)	----	(13)	(11)	(13)	(8)	(8)	(6)	(5)	(1)
Hatchability	75%	58%	----	69%	64%	77%	43%	57%	100%	60%	100%
	(8)	(18)	----	(13)	(11)	(13)	(7)	(7)	(4)	(5)	(1)
Hatchlings Per Attempt	1.38	1.32	----	1.40	1.38	1.43	1.09	1.29	2.08	1.43	1.78
	(8)	(19)	----	(15)	(13)	(14)	(11)	(14)	(12)	(14)	(9)
Mean Brood Size at Hatching	1.70	1.92	----	1.75	1.64	1.67	1.50	1.80	2.08	1.82	2.00
	(10)	(13)	----	(12)	(11)	(12)	(8)	(10)	(12)	(11)	(8)
Nestling Survival	74%	92%	----	55%	50%	60%	83%	36%	67%	83%	50%
	(9)	(12)	----	(11)	(9)	(10)	(6)	(7)	(5)	(9)	(2)

* Does not include data from sites where investigator manipulations (disease treatment, fostering, shade devices or insecticide spraying) may have affected the parameter in question. Data from previous years have been recalculated accordingly - see methods section.

Table 2. Prairie falcon reproductive parameters in the BPSA, 1973-80.* Sample sizes in parentheses.

	1973	1974	1975	1976	1977	1978	1979	1980
Percent Breeding	----	94%	92%	100%	87%	96%	92%	94%
	----	(16)	(24)	(23)	(23)	(24)	(39)	(50)
% of Attempts Successful	20%	67%	86%	79%	68%	49%	70%	63%
	(5)	(12)	(22)	(29)	(34)	(37)	(20)	(51)
No. Fledged Per Successful Attempt	3.27	4.00	3.80	3.95	3.74	3.67	3.73	4.09
	(11)	(18)	(30)	(43)	(35)	(30)	(30)	(34)
No. Fledged Per Pair	----	2.37	2.78	2.99	2.21	1.43	2.08	2.20
Clutch Size	4.50	4.40	4.35	4.48	4.68	4.35	4.67	4.28
	(2)	(10)	(17)	(25)	(28)	(34)	(30)	(47)
Hatchability	----	79%	80%	76%	86%	67%	83%	77%
	(1)	(9)	(15)	(23)	(26)	(29)	(18)	(28)
Hatchlings Per Attempt	----	3.30	3.47	3.36	3.66	2.91	4.69	3.36
	(2)	(10)	(15)	(25)	(32)	(35)	(13)	(33)
Mean Brood Size at Hatching	----	4.00	3.85	3.96	4.05	3.96	4.47	4.00
	----	(13)	(20)	(25)	(41)	(28)	(19)	(33)
Nestling Survival	----	78%	93%	82%	64%	71%	81%	83%
	----	(12)	(17)	(21)	(32)	(22)	(16)	(27)

* Does not include data from sites where investigator manipulations (disease treatment, fostering, shade devices or insecticide spraying) may have affected the parameter in question. Data from previous years have been recalculated accordingly - see methods section.

Table 3. Red-tailed hawk reproductive parameters in the BPSA, 1973-80.* Sample sizes in parentheses.

	1973	1974	1975	1976	1977	1978	1979	1980
Percent Breeding	93% (14)	85% (20)	96% (24)	79% (24)	89% (27)	91% (35)	85% (40)	83% (23)
% of Attempts Successful	57% (14)	67% (18)	70% (23)	68% (25)	48% (31)	74% (35)	90% (31)	68% (34)
No. Fledged Per Successful Attempt	3.13 (8)	2.92 (13)	2.76 (17)	2.63 (16)	2.47 (17)	2.50 (24)	2.63 (32)	2.63 (24)
No. Fledged Per Pair	1.55	1.45	1.85	1.41	1.02	1.68	2.01	1.48
Clutch Size	2.00 (1)	3.00 (11)	3.25 (16)	3.06 (18)	2.95 (19)	2.71 (14)	2.75 (4)	2.67 (9)
Hatchability	50% (1)	88% (11)	78% (14)	52% (16)	60% (16)	61% (12)	75% (4)	44% (8)
Hatchlings Per Attempt	1.83 (6)	2.69 (13)	2.71 (17)	1.94 (18)	2.05 (22)	1.94 (18)	2.29 (7)	2.30 (20)
Mean Brood Size at Hatching	2.75 (4)	2.85 (13)	3.07 (15)	3.18 (11)	3.00 (17)	2.47 (15)	2.67 (6)	2.88 (16)
Nestling Survival	50% (4)	77% (13)	80% (14)	91% (8)	39% (10)	73% (13)	83% (4)	67% (12)

* Does not include data from sites where investigator manipulations (disease treatment, fostering, shade devices or insecticide spraying) may have affected the parameter in question. Data from previous years have been re-calculated accordingly - see methods section.

Table 4. Raven reproductive parameters in the BPSA, 1973-80.* Sample sizes in parentheses.

	1973	1974	1975	1976	1977	1978	1979	1980
Percent Breeding	----	92%	90%	89%	95%	87%	81%	92%
	----	(12)	(20)	(19)	(22)	(31)	(26)	(25)
% of Attempts Successful	67%	61%	68%	76%	71%	66%	76%	79%
	(3)	(18)	(25)	(25)	(38)	(32)	(21)	(29)
No. Fledged Per Successful Attempt	4.45	4.17	3.91	4.09	3.86	3.86	3.95	4.29
	(11)	(12)	(22)	(22)	(21)	(21)	(21)	(28)
No. Fledged Per Pair	----	2.16	2.18	2.50	2.29	1.83	2.34	3.12
Clutch Size	5.33	5.70	5.15	5.56	5.27	4.87	4.71	4.80
	(3)	(10)	(13)	(9)	(22)	(15)	(7)	(10)
Hatchability	42%	56%	77%	52%	46%	89%	46%	75%
	(2)	(6)	(6)	(3)	(9)	(3)	(4)	(4)
Hatchlings Per Attempt	2.50	3.00	3.62	4.50	2.77	5.20	1.67	4.00
	(2)	(7)	(8)	(8)	(13)	(5)	(3)	(5)
Mean Brood Size at Hatching	5.33	3.62	4.38	5.00	4.50	5.20	5.00	5.00
	(3)	(8)	(8)	(8)	(8)	(5)	(2)	(4)
Nestling Survival	90%	43%	58%	87%	76%	82%	90%	100%
	(2)	(7)	(6)	(6)	(7)	(3)	(2)	(4)

* Does not include data from sites where investigator manipulations (disease treatment, fostering, shade devices or insecticide spraying) may have affected the parameter in question. Data from previous years have been recalculated accordingly - see methods section.

Table 5. Ferruginous hawk reproductive parameters in the BPSA, 1973-80.* Sample sizes in parentheses.

	1973	1974	1975	1976	1977	1978	1979	1980
Percent Breeding	----	50%	83%	83%	67%	83%	60%	71%
	----	(4)	(6)	(6)	(12)	(12)	(15)	(17)
% of Attempts Successful	0%	33%	50%	83%	31%	60%	67%	92%
	(3)	(3)	(4)	(6)	(13)	(10)	(9)	(12)
No. Fledged Per Successful Attempt	----	2.00	3.00	3.56	1.50	3.00	2.83	2.70
	----	(1)	(2)	(9)	(2)	(5)	(6)	(10)
No. Fledged Per Pair	----	0.26	1.25	2.45	0.29	1.38	1.14	1.76
Clutch Size	3.67	----	----	4.00	3.86	3.60	1.50	4.00
	(3)	----	----	(3)	(7)	(5)	(2)	(4)
Hatchability	67%	----	----	83%	52%	100%	50%	100%
	(3)	----	----	(3)	(4)	(4)	(2)	(1)
Hatchlings Per Attempt	2.33	0.00	1.00	3.40	2.00	3.60	2.25	3.00
	(3)	(1)	(2)	(5)	(5)	(5)	(4)	(3)
Mean Brood Size at Hatching	3.50	----	2.00	3.40	2.50	3.61	3.00	3.00
	(2)	----	(1)	(5)	(4)	(5)	(3)	(3)
Nestling Survival	0%	----	100%	85%	33%	58%	92%	100%
	(2)	----	(2)	(4)	(4)	(3)	(3)	(3)

* Does not include data from sites where investigator manipulations (disease treatment, fostering, shade devices or insecticide spraying) may have affected the parameter in question. Data from previous years have been recalculated accordingly - see methods section.

Ferruginous hawk reproduction also improved in 1980 (Table 5). The percent of breeding attempts successful reached a new high of 92%, and at three nests where both number hatched and number fledged were known, 100% of all young survived. Ferruginous hawks fledged an average of 1.76 young per pair, the highest rate observed since 1976.

Food Habits

Twenty-nine species of prey were found in golden eagle nests in 1980 (Table 6). As in past years, black-tailed jackrabbits (Lepus californicus) were the most common prey items, accounting for 82% of the individuals and 90% of the estimated biomass in the eagle diet. Cottontails (Sylvilagus nuttallii) were the second most prevalent food item in the eagle diet, and ring-necked pheasants (Phasianus colchicus) ranked third. Relative proportions of all food items were similar to those recorded in previous years.

Townsend ground squirrels were the most common of 19 prey species found in prairie falcon nests in 1980 (Table 7). Ground squirrels comprised 75% of the diet by frequency and 84.3% by biomass, compared with 43% and 59% in 1979. The proportion of mammals in the falcon diet has increased steadily since the 1977 drought, and the proportion of birds and reptiles has decreased. The relative proportion of ground squirrels in the diet was higher in 1980 than in any other year recorded (including pre-drought years). No other prey species accounted for more than 6% of the falcon diet. Horned larks (Eremophila alpestris) and unidentified passerines ranked second in frequency, and black-tailed jackrabbits ranked second in biomass.

Twenty-five species of prey were found at red-tailed hawk nests in 1980 (Table 8). Townsend ground squirrels were the most important single species by frequency (21.4%), but black-tailed jackrabbits and mountain cottontails comprised a higher proportion of the biomass. Lagomorphs comprised 53.9% of the total biomass and only 22% of the frequency. Gopher snakes (Pituophis melanoleucus) were another important food item, accounting for 13% of the individuals and 10% of the estimated biomass. Unlike the prairie falcon diet, the red-tailed hawk diet has shown similar proportions of birds, mammals, and reptiles in all post-drought years. The proportion of ground squirrels in the red-tailed hawk diet showed almost no change from 1979 to 1980 (20.5 and 21.4%, respectively).

Townsend ground squirrels were the most frequent prey item at ferruginous hawk nests sampled in 1980 (29% frequency, Table 9), but black-tailed jackrabbits contributed more biomass (32%). Townsend pocket gophers (Thomomys townsendii) ranked second in frequency (18%) and third in biomass (18%). A total of 13 different prey species were found at ferruginous hawk nests.

In 1980, ravens continued to feed on a large variety of prey (Table 10). More than 40 species of prey items were found in castings collected at common raven nests. Beetles (Scarabaeidae) were the most frequent prey identified (39%), but they contributed almost no biomass (0.5%) to the overall diet. Lagomorphs contributed the most biomass with 42% followed by Townsend ground squirrels with 27%.

Table 6. Prey Items found at systematically sampled golden eagle nest sites, 1980.

Species	No. of Individuals	Percent of Individuals	Biomass (g)	Percent Biomass	Kcal	Percent Kcal
MAMMALS						
Black-tailed Jackrabbit	239	46.9	371,954	70.9	494,327	67.8
Mountain Cottontail	136	26.7	80,649	15.4	107,183	14.9
Townsend Ground Squirrel	22	4.3	3,922	0.7	8,632	1.2
Bushy-tailed Woodrat	8	1.6	1,562	0.3	2,518	0.3
Yellow-bellied Marmot	5	1.0	8,721	1.7	14,058	2.0
Meadow Mouse	2	0.4	60	0.0	97	0.0
Townsend Pocket Gopher	1	0.2	240	0.0	387	0.1
Muskrat	1	0.2	1,277	0.2	2,059	0.3
Pygmy Rabbit	1	0.2	100	0.0	133	0.0
Desert Woodrat	1	0.2	150	0.0	242	0.0
Coyote	1	0.2	2,043	0.4	2,860	0.4
Long-tailed Weasel	1	0.2	178	0.0	249	0.0
SUBTOTAL	418	82.1	470,856	89.6	632,745	87.0
BIRDS						
Ring-necked Pheasant	33	6.5	33,593	6.4	55,361	7.7
Rock Dove	7	1.4	2,324	0.4	3,830	0.5
Starling	4	0.8	316	0.1	572	0.1
Western Meadowlark	3	0.6	288	0.1	521	0.1
Chukar	2	0.4	1,204	0.2	1,984	0.3
Barn Owl	2	0.4	1,206	0.2	2,098	0.3
Avian, Unid.	2	0.4	900	0.2	1,629	0.2
Mourning Dove	2	0.4	268	0.1	442	0.1
Ring-billed Gull	1	0.2	497	0.1	819	0.1
Mallard	1	0.2	1,248	0.2	2,057	0.3
Bobwhite	1	0.2	248	0.0	409	0.1
Pintail	1	0.2	976	0.2	1,608	0.2
SUBTOTAL	59	11.7	43,068	8.2	71,330	10.0
REPTILES						
Gopher Snake	19	3.7	4,006	0.8	5,568	0.8
FISH						
Carp	11	2.2	6,330	1.2	9,432	1.3
Squawfish	1	0.2	100	0.0	149	0.0
Whitefish	1	0.2	80	0.0	119	0.0
Perch, Unid.	1	0.2	80	0.0	119	0.0
SUBTOTAL	14	2.8	6,590	1.2	9,819	1.3
TOTAL	510		524,520		719,462	

Table 7. Prey Items found at systematically sampled prairie falcon nest sites, 1980.

Species	No. of Individuals	Percent of Individuals	Biomass (g)	Percent Biomass	Kcal	Percent Kcal
MAMMALS						
Townsend Ground Squirrel	187	75.1	34,121	84.3	75,100	88.4
Mountain Cottontail	3	1.2	758	1.9	1,007	1.2
Black-tailed Jackrabbit	3	1.2	1,950	4.8	2,592	3.1
Townsend Pocket Gopher	1	0.4	50	0.1	81	0.1
Mouse, Unid.	1	0.4	25	0.1	40	0.0
Bushy-tailed Woodrat	1	0.4	213	0.5	343	0.4
Least Chipmunk	1	0.4	32	0.1	52	0.1
Great Basin Pocket Mouse	1	0.4	15	0.0	24	0.0
Rodent, Unid.	1	0.4	10	0.0	16	0.0
Meadow Mouse	1	0.4	30	0.1	48	0.1
SUBTOTAL	200	80.3	37,204	91.9	79,303	93.4
BIRDS						
Horned Lark	15	6.0	390	1.0	706	0.8
Passerine, Unid.	15	6.0	840	2.1	1,520	1.8
Western Meadowlark	6	2.4	576	1.4	1,043	1.2
Mourning Dove	4	1.6	536	1.3	883	1.0
Swallow, Unid.	3	1.2	75	0.2	136	0.2
Rock Dove	2	0.8	664	1.6	1,094	1.3
Night Hawk	1	0.4	106	0.3	175	0.2
SUBTOTAL	46	18.4	3,187	7.9	5,557	6.5
REPTILES						
Leopard Lizard	2	0.8	49	0.1	65	0.1
Whiptail Lizard	1	0.4	15	0.0	20	0.0
SUBTOTAL	3	1.2	64	0.1	85	0.1
TOTAL	249		40,455		84,945	

Table 8. Prey Items found at systematically sampled red-tailed hawk nest sites, 1980.

Species	No. of Individuals	Percent of Individuals	Biomass (g)	Percent Biomass	Kcal	Percent Kcal
MAMMALS						
Townsend Ground Squirrel	77	21.4	13,834	15.9	30,449	22.8
Mountain Cottontail	46	12.8	17,885	20.5	23,769	17.8
Black-tailed Jackrabbit	28	7.8	24,388	28.0	32,412	24.3
Kangaroo Rat, Unid.	18	5.0	954	1.1	1,600	1.2
Towensend Pocket Gopher	13	3.6	2,390	2.7	3,853	2.9
Meadow Mouse	8	2.2	240	0.3	387	0.3
Whitetail Antelope Squirrel	6	1.7	636	0.7	1,337	1.0
Deer Mouse	5	1.4	95	0.1	153	0.1
Woodrat, Unid.	5	1.4	1,150	1.3	1,854	1.4
Rabbit, Unid.	5	1.4	4,735	5.4	6,293	4.7
Harvest Mouse	3	0.8	33	0.0	53	0.6
Pocket Gopher, Unid.	3	0.8	600	0.7	967	0.7
Bushy-tailed Woodrat	2	0.6	426	0.5	687	0.5
Great Basin Pocket Mouse	1	0.3	15	0.0	24	0.0
Long-tailed Weasel	1	0.3	178	0.2	249	0.2
Yellow-bellied Marmot	1	0.3	500	0.6	806	0.6
Desert Woodrat	1	0.3	150	0.2	242	0.2
Ord Kangaroo Rat	1	0.3	53	0.1	85	0.1
SUBTOTAL	224	62.4	68,262	78.3	105,220	79.4
BIRDS						
Passerine, Unid.	7	1.9	392	0.4	710	0.5
Western Meadowlark	5	1.4	480	0.6	869	0.7
Swallow, Unid.	4	1.1	100	0.1	181	0.1
Ring-necked Pheasant	4	1.1	3,548	4.1	5,847	4.4
Cliff Swallow	3	0.8	77	0.1	139	0.1
Horned Lark	3	0.8	78	0.1	137	0.1
Avian, Unid.	3	0.8	245	0.3	443	0.3
Mourning Dove	3	0.8	402	0.5	662	0.5
Rock Dove	2	0.6	664	0.8	1,094	0.8
Sage Thrasher	1	0.3	37	0.0	67	0.1
Burrowing Owl	1	0.3	170	0.2	296	0.2
Canyon Wren	1	0.3	10	0.0	18	0.0
SUBTOTAL	37	10.2	6,203	7.2	10,463	7.8
REPTILES						
Gopher Snake	47	13.1	8,825	10.1	12,267	9.2
Whiptail Lizard	17	4.7	257	0.3	339	0.3
Striped Whipsnake	10	2.8	1,090	1.3	1,515	1.1
Western Fence Lizard	6	1.7	102	0.1	135	0.1
Western Rattlesnake	5	1.4	2,000	2.3	2,780	2.1
Racer	3	0.8	231	0.3	321	0.2

Table 8 (cont.)

Species	No. of Individuals	Percent of Individuals	Biomass (g)	Percent Biomass	Kcal	Percent Kcal
REPTILES (cont.)						
Night Snake	2	0.6	28	0.0	39	0.0
Leopard Lizard	2	0.6	46	0.1	61	0.0
Ground Snake	2	0.6	16	0.0	22	0.0
Horned Lizard	2	0.6	36	0.0	48	0.0
SUBTOTAL	96	26.9	12,631	14.5	17,527	13.0
AMPHIBIANS						
Woodhouse's Toad	1	0.3	25	0.0	33	0.0
Spadefoot Toad	1	0.3	12	0.0	16	0.0
SUBTOTAL	2	0.6	37	0.0	49	0.0
INVERTEBRATES						
Locustidae	1	0.3	1	0.0	2	0.0
TOTAL	360		87,134		133,261	

Table 9. Prey Items found at sampled ferruginous hawk nest sites, 1980.

Species	No. of Individuals	Percent of Individuals	Biomass (g)	Percent Biomass	Kcal	Percent Kcal
MAMMALS						
Townsend Ground Squirrel	13	28.9	2,526	23.8	5,560	32.0
Townsend Pocket Gopher	8	17.8	1,920	18.1	3,095	17.8
Black-tailed Jackrabbit	3	6.7	3,407	32.2	4,528	26.1
Pocket Gopher, Unid.	2	4.4	400	0.8	645	3.7
Kangaroo Rat, Unid.	1	2.2	53	0.5	85	0.5
Great Basin Pocket Mouse	1	2.2	15	0.1	24	0.1
Mountain Cottontail	1	2.2	558	5.3	742	4.3
SUBTOTAL	29	64.4	8,879	83.8	14,679	84.5
BIRDS						
Passerine, Unid.	7	15.6	392	3.7	710	4.1
Chukar	1	2.2	602	5.7	992	5.7
SUBTOTAL	8	17.8	994	9.4	1,702	9.7
REPTILES						
Whiptail Lizard	3	6.7	45	0.4	59	0.3
Gopher Snake	2	4.4	422	4.0	587	3.4
Horned Lizard	2	4.4	48	0.5	63	0.4
Snake, Unid.	1	2.2	207	2.0	288	1.7
SUBTOTAL	8	17.7	722	6.9	997	5.8
TOTAL	45		10,595		17,377	

Table 10. Prey Items found at sampled raven nest sites, 1980.

Species	No. of Individuals	Percent of Individuals	Biomass (g)	Percent Biomass	Kcal	Percent Kcal
MAMMALS						
Townsend Ground Squirrel	82	9.7	14,833	21.7	32,647	30.1
Rabbit, Unid.	45	5.3	18,295	26.8	24,314	22.4
Kangaroo Rat, Unid.	43	5.1	2,279	3.3	3,674	3.4
Townsend Pocket Gopher	20	2.4	3,980	5.8	6,416	5.9
Deer Mouse	19	2.2	361	0.5	582	0.5
Meadow Mouse	14	1.6	420	0.6	677	0.6
Black-tailed Jackrabbit	10	1.2	8,138	11.9	10,815	10.0
Harvest Mouse	10	1.2	110	0.2	177	0.2
Woodrat, Unid.	9	1.1	2,070	3.0	3,337	3.1
Great Basin Pocket Mouse	8	0.9	120	0.2	193	0.2
Mountain Cottontail	7	0.8	2,231	3.3	2,965	2.7
Black-tailed Jackrabbit	2	0.2	480	0.7	715	0.7
Desert Woodrat	1	0.1	190	0.3	283	0.3
Mouse, Unid.	1	0.1	25	0.0	40	0.3
Bushy-tailed Woodrat	1	0.1	213	0.3	343	0.3
SUBTOTAL	272	32.0	53,745	78.6	87,178	80.4
BIRDS						
Bird Eggs	45	5.3	900	1.3	1,629	1.5
Passerine, Unid.	6	0.7	336	0.5	608	0.6
Avian, Unid.	5	0.6	800	1.2	1,448	1.3
Horned Lark	1	0.1	26	0.0	47	0.0
Loggerhead Shrike	1	0.1	51	0.1	92	0.1
Raven	1	0.1	650	1.0	1,177	1.1
Western Meadowlark	1	0.1	96	0.1	174	0.2
Rock Dove	1	0.1	332	0.5	547	0.5
Black-billed Magpie	1	0.1	170	0.2	274	0.3
SUBTOTAL	62	7.2	3,361	4.9	5,996	5.6
REPTILES						
Gopher Snake	10	1.2	1,939	2.8	2,695	2.5
Horned Lizard	7	0.8	126	0.2	166	0.2
Snake, Unid.	4	0.5	828	1.2	1,151	1.1
Whiptail Lizard	3	0.4	45	0.1	59	0.1
Lizard, Unid.	2	0.2	32	0.0	42	0.0
Striped Whipsnake	1	0.1	109	0.2	152	0.1
Ground Snake	1	0.1	8	0.0	11	0.0
Western Fence Lizard	1	0.1	17	0.0	22	0.0
SUBTOTAL	29	3.4	3,104	4.5	4,298	4.0

Table 10 (cont.)

Species	No. of Individuals	Percent of Individuals	Biomass (g)	Percent Biomass	Kcal	Percent Kcal
AMPHIBIANS						
Woodhouse's Toad	1	0.1	20	0.0	26	0.0
Toad, Unid.	1	0.1	20	0.0	26	0.0
SUBTOTAL	2	0.2	40	0.0	54	0.0
FISH						
Carp	8	0.9	4,664	6.8	6,949	6.4
Fish, Unid.	4	0.5	1,809	2.6	2,695	2.5
Sucker	2	0.2	230	0.3	343	0.3
SUBTOTAL	14	1.6	6,703	9.7	9.987	9.2
INVERTEBRATES						
Scarabaeidae	330	38.9	330	0.5	759	0.7
Scorpionidae	18	2.1	18	0.0	42	0.0
Locustidae	13	1.5	13	0.0	30	0.0
SUBTOTAL	361	42.5	361	0.5	831	0.7
MISCELLANEOUS						
Misc. Vegetation	100	11.8	1,000	1.5	0	0.0
Corn	9	1.1	9	0.0	0	0.0
SUBTOTAL	109	12.9	1,009	1.5	0	0.0
TOTAL	849		68,323		108,346	

Aerial Transects

Numbers of golden eagles seen on 7,000 mi^2 of transects dropped to 21 in 1980 after a consistent 3-year average of 27 for 1977-79 (Table 11). The proportion of immatures seen, however, increased from 22% in 1979 to 42% in 1980. The proportion of immatures seen on midwinter counts has been increasing since 1976, presumably reflecting improved eagle reproduction in the area.

Banding and Marking

During 1980, 25 golden eagles, 79 prairie falcons, 39 red-tailed hawks, 36 ferruginous hawks, 83 ravens, 4 marsh hawks (Circus cyaneus), 2 short-eared owls (Asio flammeus), 1 barn owl (Tyto alba), and 1 screech owl (Otus asio) were banded. Twenty-five golden eagles were wing-marked. Jeff Marks from the University of Montana banded 114 long-eared owls (Asio otus) in his cooperative study (see the long-eared owl study annual report).

Table 11. Results of aerial transect sampling on 17,920 km^2 (7,000 mi^2) of the Snake River floodplain, 1972-80.

Date	No. Adults	No. Immatures	No. Unknown	Total	Percent Immature	Eagles/100 mi^2 /(100 km^2)
Oct. 72	10	11	8	29	52%	5.8(2.2)
Feb. 73	33	33	18	84	50%	16.8(6.4)
Oct. 73	7	3	7	17	30%	3.4(1.3)
Jan. 74	20	9	12	41	31%	8.2(3.2)
Oct. 74	4	2	10	16	33%	3.2(1.2)
Feb. 75	17	8	7	32	32%	6.4(2.5)
Oct. 75	10	0	5	15	00%	3.0(1.2)
Jan. 76	24	9	6	39	27%	8.1(3.1)*
Oct. 76	4	0	3	7	00%	1.4(0.5)
Feb. 77	16	1	9	26	06%	5.2(2.0)
Oct. 77	5	0	6	11	00%	2.2(0.8)
Jan. 78	16	3	10	29	16%	5.8(2.2)
Oct. 78	8	2	6	16	20%	3.2(1.2)
Jan. 79	14	4	9	27	22%	5.4(2.1)
Jan. 80	11	8	2	21	42%	4.2(1.6)

* Survey incomplete due to fog: calculated on the basis of 475 mi^2 surveyed.

LITERATURE CITED

Kochert, M. N., A. R. Bammann, K. Steenhof, J. Doremus, M. DeLate, J. Oakley, and T. Hamer. 1977. Reproductive performance, food habits and population dynamics of raptors in the Snake River Birds of Prey Natural Area. Pages 1-39 in Snake River Birds of Prey Research Project Annual Report. U.S.D.I., Bureau of Land Manage., Boise, Idaho.

U.S.D.I. Bur. Land Manage. 1979. Snake River Birds of Prey Special Research Report to the Secretary of the Interior. Boise District, Idaho.

TITLE: Bioenergetics of nesting golden eagles.

INVESTIGATORS: Michael W. Collopy, Principal Investigator
Thomas Edwards, Research Technician
David W. Blasdell, Research Assistant
Kathy Collopy, Research Assistant

COOPERATOR: School of Natural Resources, University of Michigan, Ann Arbor, MI. 48105.

OBJECTIVES:

1. To determine quantitatively, the food consumption and growth of nesting golden eagles.

2. To assess the relationship between the rate of food delivery, growthrates and survivorship of nestling eagles.

3. To assess parental investment of male and female adult eagles during the nesting season.

RESULTS

A dissertation entitled "Food Consumption and Growth Energetics of Nestling Golden Eagles" was completed. The methods of the bioenergetic experiments with captive golden eagle chicks and the field study are described. Results of the bioenergetic feeding experiments with captive chicks are presented in terms of food consumption, metabolism, growth, and metabolized energy of the chicks. Results of the field study are presented in terms of parental care behavior, nestling development, food habits, and nestling growth. The dissertation discusses parental care and nestling food consumption, energy metabolism and growth of nestlings as well as golden eagle reproductive strategies.

A copy of the dissertation is available from Dissertation Abstracts, University of Michigan, Ann Arbor, Michigan 48105.

TITLE: Ecology of Townsend ground squirrels and demography of small mammals and birds in the Snake River Birds of Prey Study Area.

CONTRACTOR: Department of Biological Sciences, University of Idaho, Moscow, Idaho 83843.

PERSONNEL: Donald R. Johnson, Principal Investigator
Graham W. Smith, Research Associate
Nicholas C. Nydegger, Research Technician
Randall M. Olsen, Research Technician
Dana L. Yensen, Research Technician

PROJECT SUPPORT: U.S. Department of the Interior, Bureau of Land Management, Contract No. 52500-CT5-1002.

OBJECTIVES:

1. Describe population variables of ground squirrel populations including productivity, recruitment, age and sex ratios, and turnover rates.

2. Ascertain yearly changes in prey species (cottontail rabbits, black-tailed jackrabbits, Townsend ground squirrels, ring-necked pheasants, passerine birds and reptiles) densities.

3. Stratify the Study Area into vegetation types and land use patterns. Check and correct where necessary the 1977-78 Birds of Prey Study Area vegetation map and sample the vegetation within each homogeneous vegetation stand.

4. Calculate the prey densities in terms of biomass within each vegetation type stratified in objective 3.

ANNUAL SUMMARY

The sampling of vegetation stands on the Birds of Prey vegetation map was completed.

We trapped 129 ground squirrels (Spermophilus townsendi) on 4 live trapping grids. Squirrel densities varied from 1.28 to 3.18 squirrels per hectare depending on the cover type. As in 1979, all female squirrels captured had bred in 1980. Dependent on the cover type black-tailed jackrabbit (Lepus californicus) densities varied from 0.30 to 0.77 rabbits per hectare. Big sagebrush (Artemisia tridentata) and greasewood (Sarcobatus vermiculatus) had the highest jackrabbit densities. Mountain cottontail (Sylvilagus nuttalli), woodrat (Neotoma sp.), and yellow-bellied marmots (Marmota flaviventris) were trapped on 3 sites but due to insufficient numbers of capture no density estimates were made. Passerine birds, pheasants, and reptiles were also censused.

METHODS

Vegetation

In 1979 vegetation stand boundaries on the 1978 vegetation map (USDI 1979a) were ground checked to verify that all vegetation within each stand was homogeneous. Lines were added or deleted as necessary. Only those lines within the proposed Conservation Area (as defined in USDI 1979b) were surveyed. Using the techniques described by Daubenmire (1959) and Asherin (1973) each homogeneous stand was surveyed for plant species canopy coverage and shrub species densities.

In 1980 those vegetation stands not sampled in 1979 were completed. Vegetation was also sampled on the 5 Townsend ground squirrel intensive trapping grids as well as the black-tailed jackrabbit spotlighting routes.

Townsend ground squirrels

Townsend ground squirrels were livetrapped twice weekly from mid-February through late June at four live trapping sites. As in 1979, the Bedspring site was not trapped because there were no squirrels living on the grid. Densities were estimated using the "removal" population enumerator as computed by the "Capture" computer program of Otis et al. (1978). The "removal" enumerator is the most appropriate enumerator of the five discussed by Otis et al. (1978) because it works well when capture probabilities vary by individual animal and by behavioral response to capture. Vegetation was sampled at all of the trapping grids in the same manner as was done for the vegetation mapping.

Eye lenses were collected (for age determination), and embryo and placental scar counts were taken from female squirrels in order to compare litter size between adult and yearling age classes.

Black-tailed jackrabbits

As in previous years, the black-tailed jackrabbit flushing transects (USDI 1979a, Gross et al. 1974) were walked in November. In addition, the average number of jackrabbits seen each day by a 2-person raptor survey crew was tabulated from field notes.

Ten spotlighting transects censusing the major vegetation types within the Study Area were run using the method of Flinders and Hansen (1973). Each transect was censused three times during mid-May to mid-June. This involved approximately 350 miles of transecting. Densities were estimated for each cover type censused using "Transect", a computer program for analysis of line transect data (Burnham et al. 1980).

Cottontail rabbits and woodrats

Mountain cottontails and woodrats were censused using capture-recapture trap lines at the canyon riparian, canyon talus and canyon rim sites trapped in 1975 through 1979. Each trap line consisted of 20

traps. Due to the low number of captures, density estimation was not possible and the effectiveness of the capture-recapture technique for censusing woodrats and especially cottontails is dubious.

Marmots

Marmot colony locations were censused from Swan Falls dam downstream to Evan's Ranch by walking both sides of the river. These data and all observations of field crews within the Study Area have been used to create a map of marmot colony locations.

Pheasants

Estimates of ring-necked pheasant (Phasianus colchieus) densities were obtained from 9 crow-count transects (Kimball 1979). The transects censused pheasants in and near agricultural areas throughout the BPSA.

Passerines

Passerine birds were censused by walking 87 4-km transects in April and early May. Transects were located within stands of homogeneous vegetation as identified on the 1978 Birds of Prey vegetation map (USDI 1979a). Bird densities were calculated using the program "Transect" (Burnham et al. 1980).

Reptiles

Reptiles were censused with the use of 12 drift fences situated in areas not sampled in the past. The drift fences were made of 3 sections of galvanized tin 20 in. (51 cm) high embedded in the ground. The fences were 100 feet (30.5 m) in length and contained 2 screen funnel traps 25 feet (7.7 m) from each end. The traps were located between the sections so that animals from either side of the barrier would be captured. The traps were shaded and checked as frequently as twice a week depending on the weather.

RESULTS

Townsend ground squirrels

Vegetation

Plant coverage on the intensive study sites in 1980 is given in Table 1.

Population characteristics

There were 129 ground squirrels captured on the intensive study sites in 1980 (Table 2). This number was less than in 1979 and much less than in 1975 and 1976 prior to the drought of 1977. The sex ratio of adults and yearlings favored females (1 to 1.55). This has

been the case in previous years (since 1975) with the exception of 1977 where males slightly outnumbered females (1 to 1.04).

Estimated densities of ground squirrels on the live trapping grids (Table 3) varied from 1.28 to 3.18 squirrels per hectare. The 1980 data showed a decrease in density on all sites from the 1979 values, and in fact reflected lower densities than in 1978 when there was no 1977 yearling cohort (due to drought).

Survivorship of squirrels from 1979 to 1980 (Table 4) favored females. These results are very similar to those observed in previous years.

Reproduction

As in 1979, all adult male, female and yearling female squirrels examined were in breeding condition in 1980. All but one of the yearling males were in breeding condition. The large number of yearlings in breeding condition in 1979 and 1980 contrasts sharply with the breeding state of yearlings in 1975 and 1976. During those years approximately 60% of the yearling females bred, but only one case of yearling male in breeding condition was noted. Due to a drought, squirrels did not breed in 1977 and there was no yearling cohort in 1978. It is likely that the increase in yearlings breeding in 1979 and 1980 is a direct result of the decreased post-drought population.

The average litter size (count of embryos or placental scars) in 1980 was 7.83 young per female. This was much decreased from the 9.21 in 1978 and 8.52 in 1979 but still higher than the 7.15 in 1975 and 7.57 in 1976. There was no reproduction in 1977. It appears that the post-drought reproductive surge, which undoubtedly resulted from decreased ground squirrel densities, has slackened.

Differentiating between yearlings and 2 year plus females was possible using eye lens weight. Yearling lens weighed from 5.2 to 7.0 milligrams while adult lens weighed from 7.2 to 9.2 milligrams. There was no significant difference in yearling and adult litter size in 1980.

Black-tailed jackrabbits

The 1980 spotlighting data reflects a slight decrease in jackrabbit density in all cover types from the 1979 values (Table 5). As in 1979, big sagebrush and greasewood had the densest jackrabbit populations.

The Gates index (Gross et al. 1974) for the fall was 42.5, also slightly lower than the 1979 value of 44.9.

The average number of rabbits seen per crew day in 1980 was 3.6. This, in contrast, was an increase from the 1979 value of 2.6.

The jackrabbit population has been on the rise since the early 1970's and increased markedly during the 1978-79 period. The population trends

indicated by the 1980 data are slightly obscure due to the minor contradiction in results from the three methods. Population growth seems to have leveled off and we expect to see the 1981 data shed some light on population direction.

Cottontail rabbits and woodrats

An insufficient number of captures for either species prevented density estimations. Due to the low capture rate the "capture-recapture" technique fails.

Marmots

Marmot colony locations have been mapped on a collection of 7.5' (1:24,000) maps of the Study Area. A few marmots were also live-trapped during cottontail and woodrat live trapping.

Pheasants

April pheasant densities were 0.10 pheasants per hectare in old agriculture and 0.07 pheasants per hectare in new agriculture. The pheasant sex ratio was 2.3 hens/cock and the average brood count was 5.3 young/hen (Canyon County - Idaho Fish and Game data. Chuck Jensen, pers. comm.).

Passerines

Data were collected using the following groupings; horned larks, meadow larks, sparrows, blackbirds and "other passerines". Sparrow species were not differentiated.

Densities for horned larks, meadow larks and sparrows are reported in Table 6.

Due to poor or insufficient data, densities for blackbirds and the "other passerine" group were not estimated.

Reptiles

We trapped for 1030 trap nights capturing 87 snakes including 7 species. Eighty three lizards were also trapped involving 5 species. Thirteen other faunal species were trapped.

Densities were calculated for snakes (Table 7) using the method of Diller (1981 pers. comm.).

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Table 1. Plant coverage (%) May 1980 on the Townsend ground squirrel intensive trapping sites.

Vegetation	Winterfat		Big Sage-brush	Winterfat-big sage	
Trapping Site	(healthy) Winter-fat	(depleted) Bed-Spring	Big Sage-brush	(burned) Burn	(unburned) Comparison
Shrubs					
Big sagebrush			10.5		9.1
Spiny Hopsage	----	----	0.5	-----	5.0
Winterfat	25.1	0.8	---	0.3	10.4
Forbs					
Cruciferae	7.1	24.1	10.9	2.7	5.1
Russian thistle	0.1	2.1	0.1	9.1	0.3
Other Forbs	0.9	1.2	1.9	0.5	2.2
Grasses					
Cheatgrass	0.1	13.0	11.1	9.3	2.1
Six weeks fescue	13.5	0.4	4.9	0.5	0.9
Indian ricegrass	----	----	---	0.7	0.1
Sandberg bluegrass	10.4	1.7	7.9	11.6	7.2
Bottlebrush squirreltail	0.5	0.1	3.5	1.0	0.8
Bare Ground	42.3	56.8	56.1	64.3	63.0

Table 2. Townsend ground squirrel captures in relation to age class on the intensive study sites 1980.

Site	Age Classes J	Y	A	U	TOTAL
Big Sage					
male	16	2	2	2	22
female	7	5	5	0	16
Winterfat					
male	10	0	1	2	13
female	5	5	3	5	18
Burn					
male	10	0	2	1	13
female	7	4	0	0	11
Comparison					
male	5	1	3	6	15
female	13	1	4	3	21
TOTAL					129
male	41		22		
female	32		34		

J = Juvenile, Y = Yearling, A = Adult, U = Unknown

Table 3. 1980 estimated densities of Townsend ground squirrels using the removal estimator and an effective trapping area of 4.84 hectares for males and 2.56 hectares for females. 95% confidence intervals in parentheses.

Site	Density Number/hectare	95% Confidence Interval
Big sage	2.23	(1.91 - 2.55)
Winterfat	1.91	(1.28 - 2.55)
Burn	1.28	(0.31 - 2.23)
Comparison	3.18	(1.59 - 4.78)

Table 4. Survivorship of Townsend ground squirrels from 1979 to 1980. Percent survival in parentheses.

Site	Juvenile 1979	Yearling 1980	Yearling & Adults in 1979	Adults in 1980
Big Sage				
male	15	2	6	1
female	8	5	10	4
Winterfat				
male	11	0	8	1
female	11	5	9	2
Burn				
male	5	0	9	2
female	7	4	6	0
Comparison				
male	13	1	8	2
female	5	1	17	2
TOTAL				
male	44	3 (7%)	31	6 (19%)
female	31	15 (48%)	42	8 (19%)

Table 5. 1980 Black-tailed jackrabbit densities from spotlighting transects.

Vegetation Type	Density (Rabbits/ha)	Number of Rabbits Observed
Big sagebrush		
Low density	0.54	159
Medium density	0.76	242
High density	0.25	46
ALL	0.76	420
Shadscale	0.30	107
Grass	0.32	51
Greasewood	0.77	53

Table 6. Passerine bird densities (number/hectare) within the Birds of Prey Study Area.

Vegetation Type	Horned Lark	Meadow Lark	Sparrow
big sagebrush	0.65	0.12	0.99
big sagebrush-winterfat	---[a]	---[a]	1.27
salt desert shrubs	0.89	---[a]	0.39

[a] unable to calculate

Table 7. Snake captures and densities from 1980 field work in the Birds of Prey Study Area.

Site	Species	# Captures	Density Est.
#1 Shadscale	No snakes captured	----	-----
#2 Winterfat	Whipsnake	3	0.82/ha
	Gopher Snake	7	1.90/ha
#3 Budsage	Whipsnake	6	1.64/ha
	Gopher Snake	2	0.54/ha
	Long-nosed Snake	2	0.65/ha
	Night Snake	2	1.87/ha
#4 Canyon Rim	Whipsnake	1	0.27/ha
	Gopher Snake	3	0.82/ha
	Night Snake	1	0.94/ha
	Ground Snake	1	-----[1]
	Racer	1	0.26/ha
#5 Marsh-Salt Shrub	Whipsnake	4	1.10/ha
	Gopher Snake	7	1.90/ha
	Rattlesnake	1	0.97/ha
#6 Grass	Gopher Snake	10	2.91/ha
#7 Greasewood	Gopher Snake	6	1.75/ha
	Racer	20	5.60/ha
#8 Big sage	Gopher Snake	1	0.34/ha
#9 Grass	Gopher Snake	6	1.65/ha
#10 Big sage	Gopher Snake	2	9.55/ha
#11 Crested wheatgrass	No snakes captured	----	-----
#12 Big sage	Gopher Snake	1	0.32/ha

[1] unable to calculate

STUDY: Productivity, nest site characteristics, and food habits of Long-eared Owls in the Snake River Birds of Prey Study Area.

COOPERATOR: Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812.

INVESTIGATOR: Jeffrey S. Marks

OBJECTIVES:

1. To determine the nesting density and annual productivity of Long-eared Owls in the BPSA.

2. To determine the influence of nest site characteristics on the nesting success of Long-eared Owls.

3. To determine the food habits of nesting Long-eared Owls.

ANNUAL REPORT

Sixty-four breeding pairs of Long-eared Owls (Asio otus) were located in the Snake River Birds of Prey Study Area (BPSA) in 1980.[1] At least 3 of these pairs renested, making a total of 67 nesting attempts. In each of 66 attempts, eggs were laid in the abandoned nest of a Black-billed Magpie (Pica pica) or a Common Crow (Corvus brachyrhynchos). One nest (Mudflat) was in a natural cavity in an oolitic limestone cliff. I banded 113 Long-eared Owls, 8 of which were subsequently found dead in or near their nests. Eighty-four owls were known to have survived to fledging age. At least 37 pairs of owls (57.8%) failed to raise any young to fledging age. Most nest failures were probably caused by predation. Preliminary observations suggest that the height of the Long-eared Owl nest, as well as its proximity to water, roads, corvid nests, and Great Horned Owl (Bubo virginianus) nests, are variables that may influence nesting success.

Long-eared Owls fed primarily on small rodents. Four species (Dipodomys ordi, Peromyscus sp., Perognathus parvus, and Microtus montanus) comprised almost 87% of the 2,032 prey items identified. Birds were unimportant as prey (1%).

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[1] Includes the Mudflat cliff nest 17 km south of the BPSA.

METHODS

Nest Census

An intensive search for active Long-eared Owl nesting sites began on 22 March. Riparian vegetation, isolated tree groves, and islands were searched for abandoned crow and magpie nests containing incubating owls. A canoe was used to access remote areas along the Snake River downstream from C.J. Strike Dam. The BLM jet boat was used to survey the river from C.J. Strike Reservoir to the Indian Cove Bridge.

Efforts were concentrated on the area between the C.J. Strike field-camp and the mouth of Sinker Creek. Suitable nesting habitat was visited throughout the nesting season in this area. The Snake River upstream from the Bruneau River mouth and downstream from the Sinker Creek mouth contained comparatively little nesting habitat, and was surveyed only once.

Each potential nest was observed with binoculars for the presence of an adult owl on the nest. In this manner, most nests were discovered without flushing adults off the nests.

Reproductive Performance

In most cases, I observed nests from a distance until the young began to leave the nest. After a nest was located, repeated visits were made to the nest area to obtain a nestling count. If the nestlings could not be counted from the ground, I climbed a tree adjacent to the nest tree to obtain a count. It was not possible to obtain a complete count for all nests. When the young began to leave the nest (at approximately 3 weeks of age) the nest area was entered and all young were banded with U.S. F. & W.S. lock-on bands. In most cases, a complete count of the number of young raised to "branching" age was obtained at this time. A branching owl is one that has left the nest to reside in surrounding vegetation prior to first flight. Owls that die during the nestling stage are difficult to account for without systematic nest visits. In some cases, young Long-eared Owls that have left the nest to branch in surrounding vegetation are difficult to locate. After the young were banded, I made repeated visits to the nest area to obtain a count of the number of young raised to fledging age at each nest. Long-eared Owls begin sustained flight at approximately 5 weeks of age. Because of the difficulty involved in locating young owls after they were out of the nest, I was not able to account for all fledgings, thus my fledge counts must be regarded as minimum values.

The presence of an adult owl in incubation position was considered a nesting attempt. A fledged young was defined as one that has reached flying age. Nests raising at least one young to fledging age were considered successful. All nests that failed were entered in an attempt to identify the cause of failure. Nests that failed during the incubation or early brood rearing stages were revisited to see if the owls attempted to renest.

Nest Sites

The following characteristics were measured or obtained for each Long-eared Owl nest:

1. Height of nest from ground; distance from nest to tree top.
2. Species and diameter at breast height of nest tree.
3. Distance from nest to grove perimeter.
4. Nest dimensions (depth, length, and width of nest cup).
5. Species responsible for original nest construction (magpie or crow).
6. Percent nest canopy present (if magpie nest).
7. Distance to water and to road.
8. Distance to active corvid and/or raptor nest.
9. Number of suitable alternate nests, and distance to these nests.
10. Numbers 1 to 6 performed on suitable alternative nests, with the exception of distance from nest to tree top.

All nest locations were plotted on BLM maps, and the mercator coordinates of the plots were determined. Tree and nest heights were measured with wooden poles marked in 0.1 m increments. Distance to water, grove perimeter, alternate nests, and active corvid and raptor nests were measured with the wooden poles, a tape measure, or by pacing. Distances greater than 500 m were obtained from U.S.G.S. maps and aerial photographs.

I assumed that any intact crow nest was suitable for Long-eared Owl occupation. A magpie nest is not suitable for a Long-eared Owl until the canopy is deteriorated enough to allow an owl to pass through the nest entrance.

Food Habits

I searched for pellets at all nest sites. Initially, pellets were collected from roosting areas near nest sites. Pellets were collected at nest sites after a nest failure or after the young began to branch. Pellets were counted as they were collected. Individual pellet collections were placed in plastic bags labelled with the date, nest site name, and source (nest or roost), and brought into the lab for dissection and analysis. A small number of pellets were analyzed in the field. All pellet contents were saved for heavy metal analysis by Richard Fitzner of Battelle Laboratories.

Identification of small mammal prey was based on cranial and mandibular characteristics. Birds were identified by skulls and feathers. One lizard was identified by scale and mandibular characteristics by Lowell Diller of the University of Idaho. Insect parts were identifiable to order. In some instances, mammalian prey were grouped into age classes based on skull size and tooth eruption. Skulls that had erupting teeth and that were noticeably smaller than average were classified as juveniles. This classification was for biomass purposes only. Undoubtably many more prey items would have been classified as juveniles if it were possible to use sexual maturity as the criterion. Some of the rodents were sexed by their innominate bones, but in many cases a specific innominate bone could not be matched with a skull or mandible, and species identification was not possible. The majority of prey items were classified as adults of unknown sex.

RESULTS

Nest Census

Sixty-four pairs of Long-eared Owls were known to have attempted to breed. In 3 cases, nests with eggs were found late in the season within the home ranges of owl pairs that had previously failed. I assumed that these 3 cases represented renesting attempts by the owls. Long-eared Owls are known to renest after an initial failure (Bent 1938, R. Johnstone pers. comm.).

The average nearest distance between nests for 63 sites was 1,143 $\pm$ 1,765 m (SD). Included in this analysis are nests found during incubation as well as nests found after the young had branched. The Mudflat nest was not included in this analysis. I undoubtedly failed to find all the nesting owl pairs. I may have missed nests that failed soon after clutch initiation.

Abandoned corvid nests suitable for Long-eared Owl use are not uniformly distributed along the Snake River and its tributaries. Scattered tree groves and shelterbelts away from the major drainages add to the heterogeneity of Long-eared Owl nesting site distribution. Without knowing the amount and distribution of nesting sites available to the owls, nesting densities reported for a given area may be biased if the nesting sites are not distributed homogeneously within the area.

The nesting density of Long-eared Owls does not appear to be directly proportional to the amount of available nests. Forty-nine Long-eared Owl nesting pairs were located in the intensively studied area from the C.J. Strike fieldcamp to the mouth of Sinker Creek (including Castle Creek, Fossil Creek, and Sinker Creek). In some areas the owl nests were clumped, with up to 4 pairs in less than 2 ha at Castle Creek Mouth North and Jack's Springs. Thirteen pairs of nesting owls were located in the area between C.J. Strike fieldcamp and the Indian Cove Bridge. Only one pair was found between Sinker Creek and the Walter's Ferry Bridge.

Reproductive Performance

The peak of egg laying was between mid-March and mid-April. Owls suspected of renesting were on eggs in early May. Long-eared Owls in southeastern Idaho have been observed on eggs in mid-April and May (Craig and Trost 1979). No attempt was made to obtain clutch size information this year. In 1979 the average clutch size for 15 Long-eared Owl nests in the BPSA was 5.53 $\pm$ 1.06 (Marks and Yensen 1980). Hatching probably began in the first week of April. By mid-May, most eggs had hatched.

Fifty-one nests were discovered during incubation and not disturbed until the young had begun to branch. Thirty-two (62.7%) of these nests failed in the first attempt. Of these 32 nests, 21 (65.6%) failed during incubation, 10 (31.2%) failed during the nestling period, and 1 (3.1%) failed after the young had branched. Two of 3 renestings were successful in fledging young.

Because of the difficulties encountered in finding young owls after they had branched, my fledge counts reflect minimum values at some nests. At least 84 young survived to fledging age. Of 113 banded young, 8 were recovered in or near their nests. Two other banded birds probably died before fledging, but bands were not recovered. Based on the information above, the number of young fledged by the 64 owl pairs was probably between 84 and 103. Using these figures, I estimated the mean number of young fledged per nesting attempt to be between 1.2 and 1.5 (n=67). The mean number of young fledged per successful pair is estimated to be between 3.1 and 3.8 (n=27), and the mean number of young fledged for all 64 pairs is estimated to be between 1.3 and 1.6. My productivity estimates may be inflated because 5 nests discovered after hatching were incorporated into the data, and some nests probably were not detected because of failure early in the nesting season.

Nest Sites

Long-eared Owls nested primarily in willows (*Salix* spp.; Table 1). Magpie nests were chosen in 45 nesting attempts (67.1%); crow nests were chosen in 21 nesting attempts (31.3%). Nest heights ranged from 1.6 to 8.1 m ($x = 3.1 \pm 1.27$ m). The percentage of successful magpie nests was similar to that of crow nests (42% and 38% respectively; Table 2). The average height of successful nests was 3.26 $\pm$ 1.51 m versus 2.98 $\pm$ 1.08 m for unsuccessful nests. The difference between the two means was not significant ($t = 0.88$, $.10 < p < .25$).

Eighteen of the magpie nests used by Long-eared Owls had partial canopies. Bent (1938), Karalus and Eckert (1974), and Craig and Trost (1979) report that Long-eared Owls occasionally add nest material or construct a nest of their own. I found no evidence that Long-eared Owls built new nests or modified old ones in the BPSA.

The analysis of data collected on nest site characteristics has not been completed, thus only the data on nest height, tree species, and nest type has been reported here.

Table 1. Nest sites selected by 64 Long-eared Owl pairs in the BPSA[1], 1980.

Nest substrate[2]	No. (%)	Avg. ht. (m)	Original nest construction		
			Magpie-canopy	Magpie-no canopy	Crow
Willow	56 (83.6)	3.0	15	22	19
Russian olive	6 (08.9)	4.6	1	3	2
Cottonwood	1 (01.5)	2.6	1	-	-
Tamarisk	1 (01.5)	1.9	1	-	-
Serviceberry	1 (01.5)	2.0	-	1	-
Squawbush	1 (01.5)	1.8	-	1	-
Cliff	1 (01.5)	2.7	-	-	-
Total	67	($\bar{x}$ = 3.1 $\pm$ 1.27)	18	27	21

[1]The cliff nest was 17 km south of the BPSA boundary. Data include 3 renests, one of which was in the same nest.

[2]Willow (*Salix* spp.); Russian olive (*Eleaeagnus angustifolia*); Cottonwood (*Populus trichocarpa*); Tamarisk (*Tamarix parviflora*); Serviceberry (*Amelanchier* sp.); Squawbush (*Rhus trilobata*).

Table 2. Long-eared Owl nest success in relation to original nest construction and nest height, BPSA 1980.

	Original nest construction			
	Magpie-canopy	Magpie-no canopy	Crow	Cliff
No. Nests (%)	18 (26.8)	27 (40.3)	21 (31.3)	1 (01.5)
Avg. height (m)	2.7	2.7	3.9	2.7
No. Successful (%)	6 (33.3)	13 (48.1)	8 (38.1)	0 (00.0)

Food Habits

Literature on food habits of Long-eared Owls is extensive (see Marti 1976), but the majority of the data were collected during nonbreeding periods. In this study, a total of 2,032 prey individuals were identified from 1,486 pellets. The mean number of prey individuals per pellet was 1.37. Mammals were the preferred prey (98.7%; Table 3). The estimated mean prey weight was 32.95 g. Marti (1976) calculated an estimated mean prey weight of 37 g for 23,888 prey items of North American Long-eared Owls.

I compared the relative frequencies of the 5 major prey species of breeding Long-eared Owls in 1979 and 1980 (Table 4). These 5 species (*Dipodomys*, *Peromyscus*, *Perognathus*, *Microtus*, and *Reithrodontomys*) comprised 94.7% of the 346 prey individuals identified in 1979 and 93.7% of the 2,032 prey individuals in 1980. The proportions of the prey individuals were significantly different between years ($\chi^2 = 44.21$, $p<.001$). The large chi-square value was primarily due to the different proportions of *Perognathus* and *Microtus* in the owl diets. This difference may be related to changes in prey populations between years. However, in 1980 many new nests were discovered in desert areas far from typical *Microtus* habitat. These same areas may have been suitable for *Perognathus*. Prey species diversity (H', Shannon and Weaver 1949) was similar for both years (1.688 in 1979, 1.733 in 1980).

The three most numerous prey were *Dipodomys*, *Peromyscus*, and *Perognathus* (Table 3). To the best of my knowledge, no study has reported *Dipodomys* to be the most important prey item of Long-eared Owls. The importance of *Dipodomys* in the diets of Long-eared Owls in the BPSA is probably related to prey species composition of desert environments. Long-eared Owls probably feed opportunistically within a limited range of prey size. Prey species weighing more than 100 g are abundant in the BPSA, yet they are seldom captured by Long-eared Owls. The skull of an adult Ring-necked Pheasant (*Phasianus colchicus*) was recovered from a Long-eared Owl pellet. No other bird remains were found in the pellet collection from this site, thus the owl probably did not consume the entire pheasant. Although unlikely, it is possible that the pheasant was already dead when the owl encountered it.

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Table 3. Prey items identified in Long-eared Owl pellets, BPSA 1980.

	No. Individ.	% Individ.	Biomass[1](g)	% Biomass
Dipodomys ordii	574	28.2	30,422	45.4
Peromyscus sp.	554	27.3	10,526	15.7
Perognathus parvus	339	16.7	5,085	07.6
Microtus montanus	292 (30 Juv)	14.4	12,690	19.0
Reithrodontomys megalotis	145	07.1	1,595	02.4
Mus musculus	64	03.1	1,088	01.6
Sylvilagus sp.	19 (Juv)	00.9	1,900	02.8
Neotoma lepida	7	00.3	1,050	01.6
Onychomys leucogaster	5	00.2	165	00.2
Thomomys townsendii	4 (Juv)	00.2	600	00.9
Sorex vagrans	2	00.1	12	Trace
Subtotal	2,005	98.5	65,133	97.2
Unid. Passeriformes	13	00.6	390	00.6
Agelaius phoeniceus	4	00.2	272	00.4
Eremophila alpestris	2	00.1	52	00.1
Euphagus cyanocephalus	1	Trace	68	00.1
Piplio erythrophthalmus	1	Trace	41	00.1
Sturnus vulgaris	1	Trace	79	00.1
Phasianus colchicus	1	Trace	905	01.4
Subtotal	23	00.9	1,807	02.8
Cnemidophorus tigris	1	Trace	17	Trace
Unid. Orthoptera	2	00.1	Trace	Trace
Unid. Coleoptera	1	Trace	Trace	Trace
Total	2,032	99.5	66,957	100.0

[1] See Appendix for weights used in calculating prey biomass.

Table 4. Relative frequencies of the 5 major prey species of BPSA Long-eared Owls, 1979[1] and 1980.

	1979		1980	
	Number	(% of total prey)	Number	(% of total prey)
Dipodomys	80	(23.1)	574	(28.2)
Peromyscus	90	(26.0)	554	(27.3)
Perognathus	31	(08.9)	339	(16.7)
Microtus	91	(26.3)	292	(14.4)
Reithrodontomys	36	(10.4)	145	(07.1)
Total	328	(94.7)	1904	(93.7)

[1]1979 data from Marks and Yensen (1980).

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Appendix. Prey weights used for biomass calculations.[1]

	Size class	Weight (g)
Dipodomys ordi	Average	53
Peromyscus sp.	Average	19
Perognathus parvus	Average	15
Reithrodontomys megalotis	Average	11
Microtus montanus	Average, juvenile	45, 30
Mus musculus	Average	17
Sylvilagus sp.	Neonate	100
Neotoma lepida	Average	150
Onychomys leucogaster	Average	33
Thomomys townsendii	Juvenile	100
Sorex vagrans	Average	6
Unid. Passeriformes	Small	30
Agelaius phoeniceus	Average	68
Eremophila alpestris	Average	26
Euphagus cyanocephalus	Average	68
Piplio erythropthalmus	Average	41
Sturnus vulgaris	Average	79
Phasianus colchicus	Average female	905
Cnemidophorus tigris	Average	17

[1]Weights from U.S.D.I. 1979 except for *Microtus* (R. Johnstone pers. comm.) and unid. Passeriformes (estimated).